ORDER

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

6882.1

8/7/02

SUBJ: **Wide Area Augmentation System Operation and Maintenance Program**

1. PURPOSE. This order provides a general overview of Airway Facilities (AF) management, operation, and maintenance of the Wide Area Augmentation System (WAAS) in the National Airspace System (NAS).

2. DISTRIBUTION. This order is distributed to division level within headquarters Airway Facilities and Air Traffic; to the division level in the FAA Logistics Center and the FAA Academy at the Mike Monroney Aeronautical Center; to branch level in the regional Air Traffic, Airway Facilities, and Logistics divisions; and to all Airway Facilities, Air Traffic, and Flight Standards field offices with a standard distribution.

3. IMPLEMENTATION. This order is effective concurrent with WAAS deployment.

4. BACKGROUND. The WAAS is a geographically diverse system requiring new responsibilities of AF management, operations, and maintenance personnel.

5. OBJECTIVE. The objectives of this order are to:

a. Assign responsibilities to cognizant AF organizations.

b. Define levels of decision making, avenues of coordination, and activities required for the safe and efficient operation of the WAAS.

6. TERMS AND DEFINITIONS.

a. WAAS Operator. AF specialist responsible for monitoring and/or controlling WAAS activities from the Operations and Maintenance (O&M) console.

b. Controlling Operator. AF specialist functioning as a WAAS controller and monitor who certifies WAAS services and systems.

c. Monitoring Operator. AF specialist functioning as a WAAS monitor only.

d. WAAS Maintainer. AF specialist who maintains Wide-area Master Stations (WMS) and Wide-area Reference Stations (WRS), and may certify WAAS systems.

e. System Administrator/Team Lead. The administrator is an operator who has been assigned administration privileges and is responsible for the control and administration of account maintenance including: system functional assignment access; initial assignment and dissemination of passwords; distribution of software upgrades; and maintenance of access/passwords database.

f. Local Maintainer. The local maintainer is an AF specialist that replaces line-replaceable units (LRU).

Distribution: A-W(AF/AT)-2; A-Y(ML/MA)-2; A-X(AF/AT/LG)-3; A-FAF/FAT/FFS-0(STD)

Initiated By: AOP-300

7. REFERENCES. Use the latest editions of the following documents. See Appendix 1, Abbreviations, for a list of abbreviations used in this order.

a. Order 1100.157, National Systems Engineering Divisions Maintenance Program Procedures, Operational Support (AOS)

b. Order 1100.158, Standard Regional Airway Facilities Divisions

c. Order 6000.10, Airway Facilities Service Maintenance Program

d. Order 6000.15, General Maintenance Handbook for Airway Facilities

e. Order 6000.30, National Airspace System (NAS) Maintenance Policy

f. Order 6000.48, General Maintenance Logging Handbook

g. Order 6030.41, Notification Plan for Unscheduled Facility and Service Interruptions and Other Significant Events

h. Order 8020.11, Aircraft Accident and Incident Notification, Investigation, and Reporting

i. Order 6040.15, National Airspace Performance Reporting System (NAPRS)

j. Order 6050.22, Radio Frequency Interference Investigation and Reporting

k. Order 6090.1, National Airspace System Managed Subsystems Development and Implementation.

l. Wide Area Augmentation System Standard Operating Procedures (SOP)

8. WAAS OVERVIEW. The WAAS will augment the U.S. Government Global Positioning System (GPS) and is designed to provide an independent means of navigation during all phases of flight for suitably equipped aviation users. GPS alone does not satisfy the integrity, accuracy, availability, and continuity of function required for civil air navigation. To meet these requirements, the WAAS provides users with a signal-in-space (SIS) containing additional ranging capability from Geostationary Earth Orbit (GEO) satellites, and integrity data and accuracy corrections. This data enables users to improve their position accuracy.

a. WAAS Equipment. GPS and GEO satellite data is received and processed at geographically dispersed WRSs. This information is forwarded to each WMS via the Terrestrial Communications Subsystem (TCS). The WMSs process the information received and determine integrity, differential corrections, and atmospheric data. The WMS data message is sent to GEO Uplink Subsystems (GUS) and is uplinked along with the other navigation messages to GEO satellites. The GEO satellites downlink this data to the users via a GPS frequency.

b. WAAS Implementation. The initial WAAS configuration consists of 25 WRSs, 2 WMSs, 2 GEOs, and 4 GUSs, and it is designed to provide independent navigation capability for suitably equipped aircraft in the WAAS service volume for all phases of flight. The end-state WAAS may include up to 70 WRSs, 6 WMSs, 6 GEOs, and 12 GUSs.

c. Airway Transportation System Specialists. Identified below are two types of FAA positions with responsibility for operating and monitoring the WAAS.

(1) WAAS Operator. The WAAS operator is responsible for monitoring and controlling the WAAS using the O&M subsystem. Two operators are required at all times, one for each of the functions

below. The duty locations of the operators are at the AF Control Centers (AFCC). The controlling operator can be at one WMS and the monitoring operator at another WMS.

(a) Controlling. One operator is logged on as "controlling," and is responsible for controlling and monitoring the status of the WAAS.

(b) Monitoring. The other operator is logged on as "monitoring," and has no control capabilities.

(2) WAAS Maintainer. The WAAS maintainer is the AF specialists that replace LRUs.

9. ORGANIZATIONAL RESPONSIBILITIES. WAAS operations, maintenance, and support responsibilities are outlined below:

a. NAS Operations Program (AOP). AOP is the AF office of primary responsibility (OPR) for WAAS and shall be responsible for:

(1) Developing and coordinating all AF WAAS program-level decisions, including those affecting system-wide operations.

(2) Coordinating with organizational elements external to the FAA.

(3) Developing overall operations and maintenance guidelines.

(4) Managing upward reporting processes.

(5) Managing WAAS operations on a national level.

(6) Coordinating and responding to reports of Radio Frequency Interference (RFI).

(7) Manage GPS anomaly reporting and mitigation coordination.

(8) Coordinate scheduled GPS testing with WAAS operations.

b. Operational Support Program (AOS). AOS shall be responsible for:

(1) Providing second level engineering support services to NAS personnel.

(2) Designing, developing, testing, and deploying software and hardware modifications.

(3) Providing release authorization associated with configuration control of the operational baseline.

(4) Maintaining technical documentation.

c. Regional AF Divisions (AXX-400). AF Divisions in the Regions shall be responsible for:

(1) Controlling and monitoring the WAAS from the responsible OCCs (if applicable).

(2) Ensuring adequate numbers of trained and certified personnel are available to support or perform WAAS operations and maintenance.

(3) Providing regional engineering support services as required to SMOs and AOS for the WAAS.

d. System Management Office (SMO). SMOs shall be responsible for:

(1) Maintaining the WMS and WRS and providing oversight of SGS maintenance.

(2) Providing staffing and management support for WAAS maintenance activities occurring within their geographic areas of responsibility.

(3) Ensuring technical personnel are available to maintain, certify, and support all maintenance activities including first-level software support.

e. FAA Logistics Center (AML). AML shall be responsible for:

(1) Managing the spares supply, performing investigations of high failure rate items, identifying potential replacements due to loss of supply or repair capability, and managing contracts for depot level repairs.

(2) Serving as the primary depot for logistics and managing all vendor supply support contracts for WAAS.

f. FAA Academy Airway Facilities Division (AMA-400). AMA-400 shall be responsible for:

(1) Developing, maintaining, and delivering WAAS training and curricula material. WAAS operator and maintainer training will be performed via distance learning methods and resident hands-on equipment training.

(2) Ensuring that the training curricula are current and consistent with WAAS design and maintenance.

g. Resources Management (AFZ). AFZ shall be responsible for:

(1) Identifying AF training requirements and assigning quotas for training.

(2) Establishing staffing levels for operating and maintaining the WAAS.

h. Aviation System Standards (AVN). AVN shall be responsible for:

(1) Developing and maintaining WAAS instrument flight procedures and performing flight inspections to verify that the WAAS SIS supports the procedures.

(2) Identifying periodic flight inspection requirements.

(3) Equipping and maintaining the flight inspection fleet to support WAAS operations in the NAS.

(4) Supporting airborne detection and location of radio frequency interference.

10. EXTERNAL ORGANIZATIONS.

a. Department of Defense (DoD). The DoD is the command authority for changing WAAS mode between Continuous Service and Military Emergency modes.

b. Satellite Control Center (SCC). The SCC is the operational control point for the GEOs and is the source for GEO status, planned satellite maneuvers, and uplink power settings.

c. United States Naval Observatory (USNO). The USNO is the source for Coordinated Universal Time (UTC) offset data and earth orientation parameters.

d. NAS Interfacility Communication System (NICS) Service Providers. The NICS service providers are the source for coordination on status for the Terrestrial Communications Network (TCN).

e. United States Coast Guard (USCG) GPS Information Center (USCGGIC). The USCGGIC is the source for GPS status data used for composite WAAS coverage.

f. Air Force Space Command (AFSC) Global Positioning System Support Center. The AFSC provides GPS satellite constellation status information.

11. WAAS MANAGEMENT, OPERATION, AND MAINTENANCE. AF responsibilities include oversight of WAAS operations, proposing and coordinating major AF program decisions, and interfacing with entities within and outside the FAA by establishing Memoranda of Agreements (MOA) with FAA directorates or other organizations.

a. Decision Hierarchy. The following levels of decision-making have been identified for the WAAS:

(1) NAS Operations (AOP). AOP shall be responsible for all WAAS program-level decisions, including those affecting system-wide operation.

(2) WAAS Operator. The WAAS operator serves in two capacities, as controlling operator and monitoring operator. WAAS operators may also perform system administration functions. Their respective responsibilities are as follows:

(a) WAAS Controlling Operator. The controlling operator is responsible for operation of the WAAS system and service. When an equipment fault is detected the operator notifies appropriate AFCC for upward reporting and coordination of restoration activities. The controlling operator is also responsible for monitoring and controlling subsystems of the WAAS and determining when individual subsystems within the WAAS can be released for maintenance activities (periodic and corrective maintenance, certification checks, etc.).

(b) WAAS Monitoring Operator. The monitoring WAAS operator shall be responsible for monitoring subsystems of the WAAS, but has no control capability while in monitor mode.

(3) WAAS Maintainer. WAAS maintainer duties shall include maintenance of the WMS and/or WRS located in their specified geographic area of responsibility. The WAAS Maintainer will also be responsible for oversight of SGS maintenance.

b. Activity Coordination. The WAAS operator positions shall be staffed continuously. These WAAS operator positions will be referred to as either controlling or monitoring operator. The controlling operator shall be responsible for coordinating periodic and corrective maintenance, updating of system parameters, and other routine operational tasks for the entire WAAS. WAAS operator tasks shall be performed in accordance with the WAAS maintenance handbook and WAAS technical instruction book.

(1) Controlling Operator. The controlling operator shall be responsible for notifying AFCC, maintenance, and Air Traffic personnel of problems, issues, and coordination requests.

(2) Additional Coordination. The controlling operator shall coordinate with contractors, military aviation personnel, law enforcement officials, airport management officials, Federal agencies, and possible interaction with foreign entities. The WAAS operators will also receive guidance from AOP on the operation of the WAAS service.

(3) Notification. In the event that equipment faults, an alert or alarm message is generated and sent to the Operations and Maintenance (O&M) display. The operator shall notify the appropriate AFCC and coordinate all maintenance and restoration activities.

(4) Aircraft Accidents and Incidents. Aircraft accident and incident activity shall be performed in accordance with Order 8020.11

c. Staffing. Dedicated staffing shall be established for WAAS operators, to provide coverage 24 hours/day, 7 days/week (24/7) at each O&M location. WAAS system specialist maintenance duties on a WMS and/or WRS shall be considered collateral activities.

d. Training. Training shall be provided for WAAS operators and maintainers.

(1) Sufficient numbers of operators and maintainers shall be trained and certified to support 24/7 operation of the WAAS.

(2) Operator training shall ensure that all operators possess sufficient knowledge and are competent to perform all WAAS operator duties and activities, and to certify WAAS services and systems as required.

(3) Maintenance training shall enable the WAAS maintainers to troubleshoot the WAAS systems and isolate, remove and replace failed Line Replaceable Units (LRU), perform system checkout, certify the systems and associated services, and return the system to service.

e. Operations. WAAS operations require the continuous presence of certified operators at the controlling and monitoring WMSs.

(1) WAAS Control. Only one WAAS operator shall be designated as a controlling operator. Other operators may log on, but only as monitoring operator, system administrator, or local maintainer. A display on the O&M console is provided prior to log-in indicating which site has control. If the controlling O&M subsystem fails, the monitoring O&M subsystem(s) automatically detect the failure and a monitoring operator at one of the monitoring O&M subsystem(s) will be required to log on and assume controlling operator responsibilities.

(2) WAAS Recording and Archiving. All GPS and WAAS data required to support performance analysis and accident/incident investigation is recorded at each on-line O&M subsystem. WAAS operators are responsible for ensuring that recording media are replaced daily to provide a continuous data record. AF shall store the media locally for 15 days.

(3) Passwords and System Access. Password protection and access to the O&M function shall be in accordance with applicable orders. To perform system functions the controlling operator will log on via user identity and password. WAAS system specialists will have unique log-on passwords at each WAAS facility for which they are responsible.

f. Maintenance.

(1) WMS, WRS, and SGS Maintenance. AF will provide maintenance and engineering support for all WMS and WRS sytems. AF specialists will control and monitor all maintenance activities associated with the SGS.

(2) Software Maintenance. Software maintenance shall be performed in accordance with AOS procedures.

g. Logistics Support. The method of logistics support to the WMS, WRS, and Government Furnished Equipment (GFE) SGS; i.e., LRU packaging and shipping, will be the responsibility of AML. The operator and maintainer shall ensure an adequate quantity of functional site spares is available. An approved set of on-site spares for each WMS, WRS, and SGS will be provided. Sites located outside of the Continental United States (OCONUS) and some remote sites will have a full complement of spares. Sites within the Continental United States (CONUS) will have a reduced set of spares. Special case site

sparing may be determined using the Spares Planning Model. Spares not located on-site shall be stored at the depot and shipped on an as-needed basis.

h. Regional Engineering Support. Regional AF divisions shall provide technical guidance and engineering assistance to all field maintenance operations for the correction of equipment or system deficiencies and for the initiation and implementation of technical changes and improvements. Regional AF divisions shall support WAAS operations by providing engineering support for installed WMS, WRS, SGS, Terrestrial Communication Network (TCN), and associated equipment.

i. National Engineering Support. AOS shall be responsible for national second level engineering support for the WAAS. Support shall be provided for the WMS, WRS, and SGS portion of the GUS and shall include:

(1) Hardware/Software Modifications. Only AOS shall authorize or implement modifications to the commissioned WAAS. AOS shall be responsible for designing, developing, testing, and deploying all hardware and software modifications.

(2) Documentation. AOS shall be responsible for:

(a) Performing the NAS documentation function for WAAS paper and electronic documentation that includes the technical instruction book, maintenance handbook, modification directives, directives case files, Commercial Off-the-Shelf (COTS) manuals, and other maintenance guidance.

(b) Authorizing or implementing changes to hardware and software maintenance engineering technical documentation.

(c) Retaining all authoring and source data files for electronic documentation.

(3) Configuration Control. AOS shall be responsible for:

(a) Controlling and maintaining the WAAS operational baseline configuration and no changes shall be made unless approved by AOS.

(b) Retaining all source code, authoring files, and source data.

(c) Ensuring that the release of the WAAS operational baseline configurations shall be deployed from the AOS maintained operational baseline.

(d) Ensuring all software/firmware modifications including site adaptation, user selectable options, and emergency modifications comply with approved configuration management procedures.

(4) Field Support. AOS shall provide national second level engineering support for all WAAS subsystems.

j. Automated Maintenance Logging and Remote Maintenance Monitoring for WAAS. AOP shall provide current and accurate data that reflect the condition of the NAS and its effects on the safe movement of air traffic. The Maintenance Management System (MMS) and the NAPRS currently provide this data and their implementing orders serve as the source of procedures, requirements, and definitions for reporting interruptions as defined in Order 6040.15 to facilities and services in the NAS.

(1) Maintenance Records. WAAS maintenance activities shall be recorded using current AF maintenance and logging systems and procedures.

(2) Maintenance Logging. Maintenance Logging shall be performed in accordance with current Order 6000.48.

(3) Centralized Monitor and Control. AF shall coordinate WAAS maintenance and perform monitor and control functions at the AFCCs.

k. Certification. In accordance with Order 6000.15 and the WAAS Maintenance Handbook, AF shall be responsible for certifying WMS, WRS, SGS portion of the GUS, the WAAS system, and the WAAS service.

(1) Controlling Operator. The controlling operator shall be responsible for certifying the WAAS system, WAAS subsystems, and WAAS service. An on-site specialist may certify the WRS and SGS subsystems.

(2) Monitoring Operator. The monitoring operator shall not be responsible for certifying any portion of the WAAS system, WAAS subsystems, or WAAS service.

(3) WAAS Maintainer. WAAS maintainers with certification authority may be required to certify the WMS, WRS, and SGS portion of the GUS.

l. GPS Anomalies. Anomalies of the GPS signal shall be reported to the National Operations Control Center (NOCC) in accordance with Order 6030.41, which includes procedures for upward reporting, response coordination, and issuing Notices to Airmen (NOTAM).

m. Radio Frequency Interference (RFI). Procedures for reporting Radio Frequency Interference (RFI) affecting the NAS are detailed in Order 6050.22.

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24/7	24 hours per day, 7 days per week
AF	Airway Facilities
AFCC	Airway Facilities Control Center, e.g., NOCC, OCC, SOC
AFSC	Air Force Space Command
AFZ	Resources Management
AMA	FAA Academy
AML	FAA Logistics Center
AOP	NAS Operations Program
AOS	Operational Support Program
AVN	Aviation System Standards
CONUS	Continental United States
COTS	Commercial Off-The-Shelf
DoD	Department of Defense
FAA	Federal Aviation Administration
GFE	Government Furnished Equipment
GEO	Geostationary Earth Orbit
GUS	GEO Uplink Subsystems
GPS	Global Positioning System
LRU	Line Replaceable Unit
MMS	Maintenance Management System
MOA	Memorandum of Agreement
NAPRS	National Airspace Performance Reporting System
NAS	National Airspace System
NICS	NAS Interfacility Communication System
NIMS	NAS Infrastructure Management System
NOCC	National Operations Control Center
NOTAM	Notice to Airmen
O&M	Operations and Maintenance
OCC	Operations Control Center
OCONUS	Outside Continental United States
OPR	Office of Primary Responsibility
RFI	Radio Frequency Interference
RMM	Remote Maintenance Monitoring
SCC	Satellite Control Center
SCRB	Software Configuration Review Board
SGS	Signal Generator Subsystem
SIS	Signal-In-Space
SMO	System Management Office
SOC	Service Operations Center
SOP	Standard Operating Procedures
TCN	Terrestrial Communications Network
TCS	Terrestrial Communications Subsystem
USCG	United States Coast Guard
USCGGIC	USCG GPS Information Center
USNO	United States Naval Observatory
UTC	Coordinated Universal Time
WAAS	Wide Area Augmentation System
WMS	Wide-Area Master Station
WRS	Wide-area Reference Station